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ABSTRACT

Technology education (TE) is a general education program intended to teach students about technological concepts, processes, materials, and systems as well as the impact of technology in society. Its goal is to develop technologically literate people. Technology education can be taught as a separate course or curriculum, or it can be infused in other subjects. Children are exposed to technology in many forms. TE experiences are motivating and interesting to young children and they provide opportunities for language development. The main goal of elementary TE is technological awareness, reinforcement, and enrichment of concepts (thinking skills). A cooperative implementation effort between elementary and technology teachers is recommended. Ohio, West Virginia, Idaho, Virginia, and the National Aeronautics and Space Administration (NASA) have developed innovative elementary TE programs. TE programs should consider the following: (1) inservice TE teacher training; (2) parent or community provision for equipment and supplies; (3) instruction in the use, care, and safe operation of equipment; and (4) examination of available sources such as NASA Teacher Resource Centers, the Technology Education for Children Council, and textbooks. (12 references) (NLA)

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ERIC Clearinghouse on Adult, Career, and Vocational Education

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PRACTICE APPLICATION BRIEF

by Sandra Kerka
1991

Technology Education in Elementary Schools

Technology education (TE) is a general education program intended to teach all students about technological concepts, processes, materials, and systems as well as the impact of technology on society. Its goal is to help people understand their technological environment in order to make rational decisions about their daily lives and societal issues--that is, to develop technologically literate persons (International Technology Education Association 1985).

Promoted as the "new basic" by the ITEA and national commissions and panels (Hull 1990), technology education--

- Draws content from the clusters communication, construction, manufacturing, and transportation (and the emerging field of biotechnology)
- Focuses on the impact of technology on people, the environment, and society
- Uses an interdisciplinary approach
- Develops problem-solving, decision-making, and creative abilities
- Develops values about the use of technological resources
- Fosters confidence in understanding technical information and positive attitudes about science and technology
- Encourages career and consumer awareness
- Prepares students for lifelong learning and adapting to change in a technological society

Although technology education evolved from industrial arts, a fundamental difference between the two is in philosophical orientation. TE is envisioned as appropriate for all levels, and as an interdisciplinary program, it can support the academic goals of elementary-secondary curricula. It can be taught as a separate course or curriculum, or it can be infused in social studies, math, science, language arts, and other subjects. It can be taught by elementary-secondary teachers, by TE specialists, or in a team approach.

As TE has developed through the last decade, evidence of its effectiveness is emerging. The NASA/Elementary Technology Education Project (Barnes, Wiatt, and Bowen 1990) found that a holistic approach integrating technology into the existing curriculum motivated students, stimulated creativity, and improved standardized test scores. Ilott and Ilott's (1988) study demonstrated that TE's blending of concrete and abstract, manual and linguistic skills, and activity-based learning contributed to language development in children.

In 300 fourth- to ninth-grade Iowa classrooms over a 3-year period (Yager et al. 1988), a comparison of traditional classes with those taught using a science/technology/society (STS) approach attributed significant improvements to STS in several areas. STS students could demonstrate the applicability of information to new settings, offer valid interpretations for observations, and choose relevant information for problem solving. They exhibited positive attitudes and increased creativity (asking more questions, distinguishing cause and effect, offering unique explanations). Their ability to identify concepts and perform such processes as selecting experimental procedures, hypothesizing, differentiating, measuring, using numbers, predicting, and drawing conclusions also improved.

This **Practice Application Brief** discusses the value of starting technology education at the elementary level, provides guidelines for implementation, and suggests resources for elementary school teachers.

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Children and Technology Education

Technology is an inescapable part of life, and children are exposed to it in many forms. Children's understanding of science is influenced by their experiences and observations, and they construct naive "theories" to explain phenomena, which influence their later learning (Hull 1990). Technology alters values, habits, and ways of living and working. These factors and its potential impact on nature make it important to begin early in developing people capable of understanding, assessing, and managing it (Peterson 1979).

"As the introduction of computers in schools has proven, youth can often accept and learn new technology easier than many adults" (Thode 1987, p. 3). TE experiences are motivating and interesting to young children, and they provide spontaneous opportunities for language development. Ilott and Ilott (1988) found that children learn and use technical vocabulary because they need the words to express their experiences with technology.

The primary goal of TE in the elementary curriculum is technological awareness, the foundation on which to build exploration and in-depth preparation in junior and senior high school. Other goals are reinforcement and enrichment of concepts in other subject areas and fostering of early attitudes about technological impacts (ITEA 1985).

An elementary TE program uses children's natural interest in manipulating materials and devices. By moving from concrete to abstract, it develops thinking skills. TE activities are adaptable to group and independent learning, and opportunities for practical applications--in the home and the community--abound (Peterson 1979), for example, identification of household hazards.

Implementing Elementary TE

Kieft (1988) recommends a cooperative implementation effort between elementary teachers and technology teachers. To such a collaboration elementary teachers bring the pedagogical expertise to structure objectives, sequence learning, organize lessons, acquire materials, and conduct activities, in addition to having knowledge of their appropriateness for particular age groups. Technology specialists can help by--

- Suggesting topics and assisting with preparation of activities
- Identifying references and resources
- Identifying tool and equipment requirements, providing materials, or recommending sources
- Offering technical suggestions to improve activities
- Highlighting safety guidelines
- Suggesting modifications if resources are not available

Ohio's *Model Industrial Technology Systems Project* (1987) uses a triplan approach to integrate 16 TE units into the K-4 curriculum. The three parts of the plan are as follows:

- Awareness--identification of TE cluster, introduction and discussion of topic
- Demonstration--examples of applications of the topic
- Participation--student hands-on activity

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Examples of unit topics include the hand as a tool, the mechanics of photocopying, and dominos as a prototype of the assembly line.

Another way to structure TE comes from West Virginia, which published a TE curriculum guide (Peterson 1979) even before the technology education "boom" of the 1980s. The West Virginia guide organizes activities on five dimensions: tools, their use and functions, products resulting from their application, social impact of the products, and the influence of technological change. Representative topics illustrate their applicability across the curriculum: effect of the train on Indians, maps, product testing, advertising, pollution.

In Idaho the Multimedia, Environmental, Sciences, and Humanities (MESH) program (Thode 1989) is provided to grades K-3 for 30 minutes per week and grades 4-6 for 50 minutes per week. The six modules cover problem solving, computer applications, robotics and automation, lasers and light applications, communication, and future technology. Sample activities include the following:

- Design and build the tallest free-standing straw structure that will support a tennis ball
- Produce a document using word processing
- Use a robot to pick up and place an object
- Produce a lasergraph or hologram

The NASA/Elementary Technology Education Project has provided support for the development of educational materials and innovative programs in elementary TE. "Mission 21" resource guides (Brusic et al. 1988) were developed to help elementary teachers establish a framework for the study of technology in grades 3-6, provide learning activity ideas, and present problem-solving themes. The themes for technology learning activities (TLAs) for third and fourth grades are community, relationships, machines, discovery; for fifth and sixth grades, communication, space colonization, inventions, and energy and matter. The problem-solving models used are age-appropriate: third and fourth graders look at the problem, explore ideas, make a model, show and tell; fifth and sixth graders brainstorm, collect information, produce a solution, and evaluate and improve.

One Virginia elementary school used the "Inventions" TLA to set up inventor stations in the classroom, where students conducted research on inventors and wrote reports on a computer. They brainstormed ideas and researched and developed their own inventions (Barnes, Wiatt, and Bowen 1990). The "Space Colonization" theme was developed by Andrews and Kirschenbaum (1987) into *Living in Space*, a two-volume resource guide with activities for grades 1-3 and 4-6. For the topics food, clothing, housing, communication, and working in space are provided objectives, vocabulary, motivating questions, activity description, and background information for each grade level.

Suggestions for Teachers

- The ITEA (1985) recommends that elementary school teachers complete preservice or inservice training in technology education.
- TE activities require tools, materials, and supplies that are sometimes unavailable in elementary schools. Parent organizations and community resources may be able to provide equipment and supplies or raise funds for their purchase (Thode 1989).
- Instruction in the use, care, and safe operation of equipment used in TE is always important, especially with the elementary school population.
- Sources of information for elementary school teachers include--
  - NASA Teacher Resource Centers (listed in Andrews and Kirschenbaum 1987)
  - ITEA and its affiliate, the Technology Education for Children Council, 1914 Association Drive, Reston, VA 22091
  - Textbooks recommended by Kieft (1988): Miller and Boyd, *Teaching Children through Constructional Activities* (Urbana, IL: Griffon, 1987); Minton and Minton, *Teaching Technology to Children* (Worcester, MA: Davis, 1987); and Scobey, *Teaching Children about Technology* (Bloomington, IL: McKnight, 1968)

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